ADVANCED IMAGING & INFORMATION PROCESSING

Pattern recognition has crucial importance for Air Force applications in Advanced Imaging and Information Processing. Neural network, fuzzy logic, and genetic algorithm methods—new technologies that can dramatically improve upon classical techniques—have shown particular promise. For example, several recent AFIT theses used neural network processing of high range resolution signals to go beyond position and velocity evaluation to obtain accurate friend-or-foe aircraft identification. "Common sense" or context-relevant intelligence in processing Air Force Command, Control, and Communications Information (C3I) data remains among the most significant and challenging long-term goals.

Steven Gustafson
Associate Professor
PhD, Duke University, 1974
- Optical processing
- Pattern recognition
- Image enhancement

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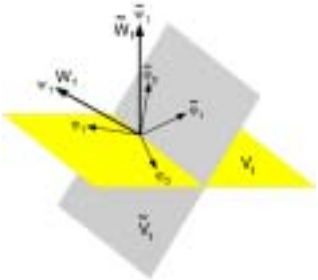

The signal and image processing group is involved with many aspects of adaptive signal processing. Our efforts center on building adaptive, non-linear wavelet transforms to improve signal representation while maintaining the multi-resolution aspects of the transform. We utilize these adaptive transforms to design new, powerful techniques for signal enhancement, signal restoration, and image compression. In addition, we are developing new image registration algorithms for the problem of super-resolution, and conducting exciting research in the real-time compression of combined audio and video signals.

Eric Magee
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PhD, The Pennsylvania State University, 1995
- Adaptive optics
- Wave propagation through turbulence
- Optical space surveillance
- Laser Radar
- Optical communications

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The Air Force pursues laser, imaging, beam control, and remote sensing technologies in support of various missions. The complexity of these technologies and deployed systems require a significant investment in research and development. The advanced imaging group at AFIT is committed to research that advances the understanding of these technology areas, minimizes their associated risk, and optimizes available resources. The management of and technical direction of optical systems development for ground and space-based applications requires knowledge in the areas of optical system design and analysis, optical system testing, optical components and fabrication processes, and material science. The advanced imaging group works closely with the Engineering Physics Department and the AFIT Academic Center for Directed Energy to produce quality graduates with this required expertise.

Roger Claypoole
Assistant Professor
PhD, Rice University, 2000

- Image compression
- Image enhancement
- Wavelet theory
- Adaptive multi-scale analysis

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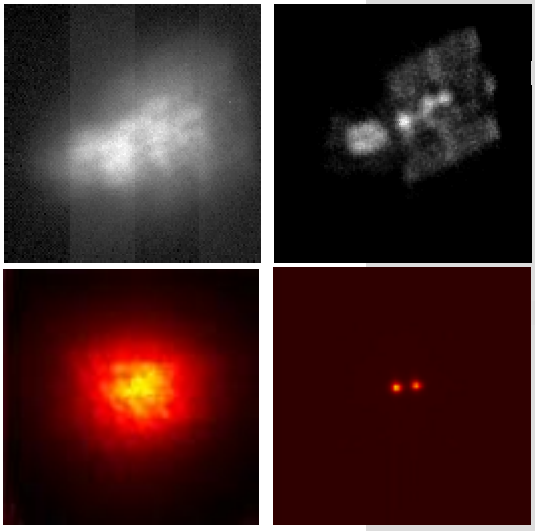
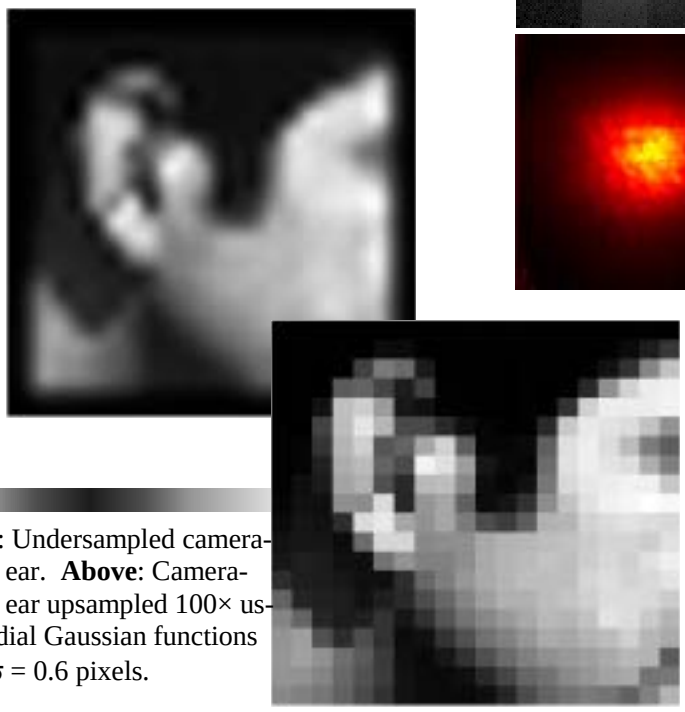


Uncompensated and Compensated ground based images of the Hubble Space Tele-

Uncompensated and Compensated ground based images of a binary star.



Right: Undersampled cameraman's ear. **Above**: Cameraman's ear upsampled 100× using radial Gaussian functions with $\sigma = 0.6$ pixels.